

**Infrared Astronomical Satellite (IRAS):
Archive Interface Control Document
For
Infrared Data of Comet 9P/Tempel 1**



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1 IMAGE ARCHIVE COLLECTION

1.1 Introduction

Archive-quality data sets include everything needed to understand and utilize the data. The images archived alone are insufficient for the science community to realize the full scientific potential of the data. Documentation is necessary to describe the data products, imaging instruments, and mission operations.

The term “archive” describes the total data collection needed to fully utilize the Reduced Data Record (RDR) image collection. The final archive is stored on CD-ROM media. This data set collection contains Infrared Astronomical Satellite (IRAS) images and photometry of comet 9P/Tempel 1 during its 1983 apparition. The collection contains 2 types of IRAS data:

- Additional (Pointed) Observations: Reprocessed images and photometry tables
- Survey Scans: Reprocessed images and photometry tables

Also included in the archive are JPEG renditions of IRAS FITS images that show the dust trail of the comet. These images are included in the Documentation area of the archive.

This data set collection supports analysis of 9P/Tempel 1 for the NASA Deep Impact Mission.

Table 1- Essential Elements of the IRAS Archive

Primary Data Sets	These are the Science data that have been processed from the raw data.
Documentation Elements	Computer readable files describing the mission, spacecraft, imaging, tables, instruments, and mission operations. IRAS observations containing the dust trail of the comet are included as documentation.
Index Elements	Tables summarizing the properties and characteristics of all images in the archive

1.2 Static CD Rom Data Volume

In the archive the static data set containing the RDR data make up virtually the entire archive volume set. Static data sets, once produced and validated, are not subject to update or modification.

1.2.1 RDR Images and Photometry

The RDR images are in FITS image format with detached PDS labels. The extensive FITS headers and PDS labels provide all the data that is needed to use the images. The RDR photometry tables are in ASCII format. They also have detached PDS headers that provide the information that is needed to use the tables.

1.2.1.1 Survey Data:

The bulk of the IRAS observation time was spent in the survey mode that systematically mapped the sky with a series of overlapping and confirming scans. Several images from the resulting IRAS Sky Survey Archive (ISSA) included comet Tempel 1.

Construction of images from survey data is complicated by the fact that the confirming scans cross each other at varying angles. Construction of comet images also requires compensation for the motion of the comet and the changing spacecraft parallax during the relatively large time interval (~103mns) between the confirming scans. They are thus “time-averaged” images of the comet emission history. Building the image is an iterative process, wherein each iteration begins with the most recent estimate of map radiance. Statistics relating to pixel noise and convergence are generated at each iteration. A typical image will converge after 15 to 40 iterations.

Image Data

Two image products were produced from the Tempel 1 survey scans:

A. Radiance Map - The radiance map is the surface brightness image produced by the CIP (Comet Image Processor) software, developed by Russell Walker and patterned after HIRES package available through the Infrared Processing and Analysis Center (IPAC). Two radiance maps were produced for archive: 1) the map resulting from the first iteration, and 2) the high-resolution map produced at the final iteration.

B. Photometric Noise Map - This is an image of the internal photometric uncertainty (standard deviation) of the radiance in a pixel as a result of averaging overlapping detector samples. The photometric noise map may be used to estimate the error in aperture photometry of the comet, photometric profiles, and flux ratios.

The image is 150x75 pixels (FITS headers NAXIS1 x NAXIS2). The coordinate system is solar elongation and observation inclination. This was the natural coordinate system of IRAS. Elongation is the angle between the line of sight and the Sun. Observation inclination is the angle between the ecliptic plane and the plane containing the Earth, Sun, and observation direction.

Photometry data

The radiance (and noise) photometry files are the result of summing the radiance (and variance) from all the pixels that are within a selected distance from the pixel of maximum comet radiance. There are three columns in the files. The first is the distance (radius) that includes the pixels summed. Zero is the central pixel, etc. The second column is the summed radiance (or noise) in units of Watts cm⁻². The third column is the number of pixels actually included in the sum. Most of the coma flux should be contained within a few pixels radius. There is 0.846125 x 10⁻⁸ steradian per 15” square pixel.

1.2.1.2 AO Data:

IRAS devoted almost 40% of its observing time to Additional Observations (AO), that is, pointed observations of selected fields of interest. Comet Tempel 1 was the target of several frames of AOs. The duration of an AO is usually less than 800 seconds. Motion compensation may not be necessary if the comet's apparent motion is sufficiently small. Russell Walker used IPAC's HIRES package to build the AO image. HIRES include an iterative process, the MCM algorithm, which was iterated 20 times. Maps were produced at the 1st, 5th, 10th and 20th iterations but only the 1st and 20th iterations are archived

Image Data:

The delivered AO images include radiance and noise images at the 1st and 20th iteration. The image is 241 x 241 pixels (NAXIS1 x NAXIS2). The coordinate system is equatorial. The comet is not centered in the image. The pixel size is 15 x 15 arcsec.

Photometry Data:

The radiance (and noise) photometry files are the result of summing the radiance (and variance) from all the pixels that are within a selected distance from the pixel of maximum comet radiance. There are three columns in the files. The first is the distance (radius) that includes the pixels summed. Zero is the central pixel, etc. The second column is the summed radiance (or noise) in units of Watts cm⁻². The third column is the number of pixels actually included in the sum. Most of the coma flux should be contained within a few pixels radius. There is 0.846125 x 10⁻⁸ steradian per 15" square pixel.

1.2.2 Index Elements

The index elements of the archive exist as ASCII summary tables. The index file carries information about the scientific parameters for each data file such as the wavelength of the observation or some geometry information. The static data volume contains one index file for the images and photometry tables on the volume.

The index elements can be loaded into a catalog system for use in image search and retrieval applications. The table is organized as a flat file; each row is an image or a table entry, and each column contains an attribute of the image or the table.

1.2.3 Documentation Elements (including Trail Images)

Documentation, stored as computer readable files, is an important supplement to the archive, preserving the knowledge of the mission after operations have concluded. The documentation includes mission, spacecraft, and instrument descriptions; literature references; and descriptions of the data products and archive contents. The documentation focuses on description of aspects of the archival data that are not published in technical journals and are not available through standard published literature. The documentation files are stored in both the document and the catalog directories, which is in the static data volume that accompanies the RDR image archive.

1.2.3.1 Dust Trail Images:

Russell Walker searched the IRAS Sky Survey Archive Reject Set and found 54 images that contained the dust trail of comet 9P/Tempel 1. The Reject Set are images taken within 20° of the ecliptic plane and are of reduced quality compared to the rest of the Survey data due to contamination by zodiacal emission residuals and the zodiacal dust bands.

For future reference, the FITS trail images were converted to JPEG images and saved in the Documentation area of this archive.

1.3 Error Handling and Data Quality Assessment

It is inevitable that errors will be introduced into the archive even with data validation procedures applied to the volumes. A plan is required to handle errors discovered in data volumes that have already been produced.

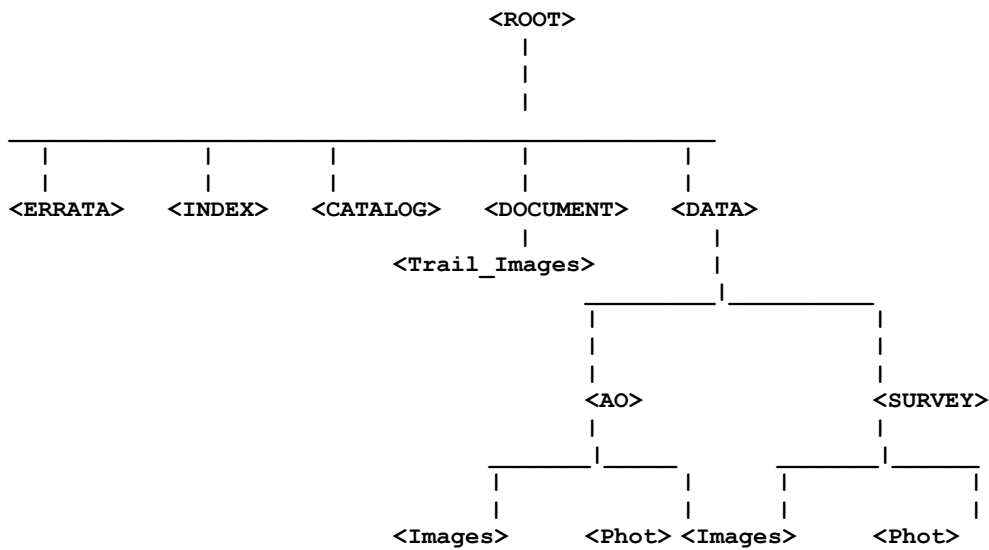
As errors are discovered, they are reported to user community. An ERRATA report file is maintained to track and document all discovered errors. At the conclusion of the production of the NC volume set, a final CD-ROM is prepared that contains corrected files for all discovered errors.

2. DIRECTORY STRUCTURE AND CONTENT FOR STATIC CD-ROM VOLUMES

2.1 Volume Directory Diagram

Table 1 shows the directory structure overview for the static volumes. Below the root directory are the DOCUMENT, INDEX, CATALOG, ERRATA, and DATA directories. A detailed description of the directory tree is provided in section 2.2. An ERRATA directory exists on the final volume in order to hold any files that were improperly processed in the volume set.

TABLE 1 Volume Directory Structure Overview



2.2 Description Of Each Directory Level

Directory Contents:

<ROOT> Directory

AAREADME.TXT - General information file. Provides users with information about the IRAS data products. Directs user to other documents on the volume containing more detailed information.

VOLDESC.CAT - PDS catalog file containing labels that describe the volume data products. Information includes: production date, producer name and institution, volume ID, etc.

ERRATA.TXT - Text file for tracking and recording discovered errors in the IRAS data products. (This is an optional file.)

<ERRATA> Directory

The <ERRATA> directory tree is reserved for the last volume in the static volume set of the archive. The tree stores data files that correct files of previous files that had errors. The directory tree maintains the same structure as on other volumes.

<DOCUMENT> Directory

The documentation files exist in several forms in order to Facilitate access to the documents.

<> Files with extension '**TXT**' or '**ASC**' are ASCII text files that can be read by virtually all text editors.

<> Files with extension '**DOC**' were created with Microsoft-word.

<> Files with extension '**EPS**' are encapsulated PostScript format.

<> Files with extension '**JPG**' are JPEG images.

DOCINFO.TXT - Description of the DOCUMENT directory

Exp_supp_AO.*- The Explanatory Supplement to the IRAS Additional Observations (AO) processed by Russell Walker. The document describes the processes used to generate radiance and noise map images and photometry tables from AOs that contain comet 9P/Tempel 1. Identical versions of the document are provided in PDS, MS-WORD, and postscript formats

Exp_Supp_AO.LBL - The PDS label for the Explanatory Supplement to the IRAS Additional Observations.

Exp_supp_survey.*- The Explanatory Supplement to the IRAS Survey Scans (SS) processed by Russell Walker. The document describes the processes used to generate radiance and noise map images and photometry tables from Survey Scans that contain comet 9P/Tempel 1. Identical versions of the document are provided in PDS, MS-WORD, and postscript formats.

Exp_Supp_Survey.LBL The PDS label for the Explanatory Supplement to the IRAS Survey Scans.

Keyword_definitions.txt- Definitions of PDS keywords used in the data labels.

IRAS_SIS.* - Contains this software Interface Specification for the IRAS data products.

<Trail_Images> Directory

Exp_supp_trail.*- The Explanatory Supplement to the IRAS Trail Images extracted by Russell Walker from the Reject Set in the IRAS Sky Survey Atlas. The document describes these unprocessed images that show the debris trail of comet 9P/Tempel 1. The extracted FITS files for converted to JPEG images for this archive. Identical versions of the document are provided in PDS, MS-WORD, and postscript formats.
I*.JPG- JPEG images containing the dust trail of the comet.
EXP_SUPP_TRAIL.LBL- The PDS label for the Explanatory Supplement to the IRAS Trail Images in JPEG format.

<CATALOG> Directory

CATINFO.TXT: Description of files in the catalog directory.
MISSION.CAT - Description of the IRAS mission.
INSTHOST.CAT - Description of the IRAS satellite.
INSTRMNT.CAT - Description of the IRAS focal plane array of detectors.
FILTERDS.CAT - Description of the 4 tables containing the transmission profiles of the IRAS broadband filters and one table describing the characteristics of the IRAS focal plane array.
DS.CAT - Description of the reprocessed Additional Observations (Pointed) images and Survey Scan images containing comet 9P/Tempel 1. Photometry tables are also described in this catalog file.
REF.CAT - References mentioned in other *.CAT files.

<INDEX> Directory

INDEX.TXT
INDEX.LBL

<DATA>

<DATA/AO> - Subdirectory of AO data.
 <DATA/AO/Image> Subdirectory containing Image data.
 <DATA/AO/Phot> Subdirectory containing Photometry data.
<DATA/Survey> - Subdirectory of SURVEY DATA.
 <DATA/Survey/Image> Subdirectory containing Image data.
 <DATA/Survey/Phot> Subdirectory containing Photometry data.

2.3 Data File Naming Convention

The file name is unique across all IRAS data products. The file names developed for PDS data volumes are restricted to a 27-character file name and a 3-character extension name with a period separating the file and extension names.

2.3.1 Naming convention for Additional Observation Data:

The IRAS AOs are identified by their satellite operations plan (SOP) and observation (OBS) number. The IRAS observations were made in four spectral bands centered nominally at 12 μ m, 25 μ m, 60 μ m, and 100 μ m. Images are supplied for the first (01) and 20th iteration (20). The images retained are for the 5th and 10th iterations because the images are inferior to the 20th. The following file names were adopted:

Radiance and Noise images in /data/ao/images

There are 80 radiance images and the naming convention is

sSOP_oOBS_Band_Iteration#_radiance.fit

There are 80 noise images and the naming convention is:

sSOP_oOBS_Band_Iteration#_noise.fit

Example:

s287_o13_100um_1_radiance.fit

SOP=287

OBS=13

BAND=100 μ m

Iteration# = 1

Radiance and Noise Coma Photometry Tables in /data/ao/phot/:

There are 20 Radiance Photometry Tables and the naming convention is:

sSOP_oOBS_Band_Iteration#_radiance.tab

There are 20 Noise Phot Tables and the naming convention is:

sSOP_oOBS_Band_Iteration#_noise.tab

Example:

s287_o13_100um_1_noise.tab

SOP=287

OBS=13

BAND=100 μ m

Iteration# = 1

2.3.2 Naming convention for Survey data:

The survey data set includes radiance and noise images, and aperture photometry files,. IRAS scans are identified by a satellite operations plan (SOP) number. A “mean” SOP number identifies the images, since several scans are used to make an image. The IRAS observations were made in four spectral bands centered nominally at 12 μ m, 25 μ m, 60 μ m, and 100 μ m. Images are supplied for the first iteration (01) and the final iteration (20) determined by the convergence of the flux in all the pixels in the scanned path.

Radiance and Noise images in /data/survey/images

There are 80 radiance images and the naming convention is:

sSOP_oOBS_Band_Iteration#_radiance.fit

There are 80 noise images and the naming convention is: —

sSOP_oOBS_Band_Iteration#_noise.fit

Example:

s287_o13_100um_1_radiance.fit
s287_o13_100um_1_noise.fit

mean SOP=287
OBS=13
BAND=100 μ m
Iteration# = 1

Radiance and Noise Coma Photometry Tables in /data/survey/phot/:

There are 20 Radiance Phot Tables and the naming convention is:
sSOP_oOBS_Band_Iteration#_radiance.tab
There are 20 Noise Phot Tables and the naming convention is:
sSOP_oOBS_Band_Iteration#_noise.tab

Example:

s287_o13_100um_1_noise.tab
s287_o13_100um_1_radiance.tab

mean SOP=287
OBS=13
BAND=100 μ m
Iteration# = 1

2.3.3 Naming convention for Dust Trail JPEG images:

There are 56 ISSA images that show a comet trail and the naming convention is:

I_{nnn}B_nH_n.JPG

Where the I is for ISSA, nnn is the plate number, B1, B2, B3, and B4 are the four IRAS bands at 12, 25, 60, and 100 μ m respectively, and H1 = HCON1, H2 = HCON2, and H3 = HCON3.

Example:

I147B4H2.JPG
Plate Number = 147
Band Number = 100 μ m
HCON2=H2

2.4 Structure Of An Individual File In PDS Format

The IRAS data products are constructed according to the data object concepts developed by the Planetary Data System (PDS) at NASA. By adopting the PDS format, the IRAS data products are consistent in content and organization with other planetary data collections. The label area of the data file conforms to the PDS version 3 standards. For

more information on this standard consult the PDS Standards Reference JPL D-7669 Document. The purpose of the PDS label is to describe the data products and provide ancillary information about the data product. An example of a PDS label for each IRAS data product is shown below:

2.4.1 Example of Survey Image Data Header In PDS Format

```
PDS_VERSION_ID= "PDS3"
LABEL_REVISION_NOTE= "2003-04-21, Ray Espiritu (ACT), initial release."
FILE_RECORDS= 18
RECORD_TYPE = "FIXED_LENGTH"
RECORD_BYTES = 2880
DATA_SET_ID= "IRAS-C-FPA-5-RDR-DI-TEMPEL1-V1.0 "
PRODUCT_ID = "S339_25UM_01_RADIANCE_200309"
PRODUCT_CREATION_TIME = 2003-04-29T16:53:05
INSTRUMENT_HOST_NAME = "INFRARED ASTRONOMICAL SATELLITE"
INSTRUMENT_NAME = "IRAS FOCAL PLANE ARRAY"
TARGET_NAME = "9P/TEMPEL 1 (1867 G1)"
START_TIME = 1983-07-14T02:53:05.360
STOP_TIME = 1983-07-14T13:11:47.180
SPACECRAFT_CLOCK_START_COUNT = 79843985.36
SPACECRAFT_CLOCK_STOP_COUNT = 79881107.18
DESCRIPTION = " This radiance map is a coaddition of individual IRAS Survey
Scans with a linear baseline subtracted then a Maximum Correlation Method (MCM)
algorithm applied for 01 iterations. The software used is a version of the
Infrared Processing and Analysis Center's (IPAC) HIRES program, utilizing the
same MCM to construct high-resolution images but changing the coordinate system
to comet-centered so that the reference frame moves with the comet. The
software, named Comet Image Pre-Processor and Processor (CIPP and CIP) are not
available at IPAC. "
PROCESSING_HISTORY_TEXT = "COMET Tempel 1 1983 XI
FLUX MAP
Iteration 001
Converged Pixels 00815
Jan 2003, PDS Small Bodies Node modified the header:
1) Corrected several keywords and values to standards.
2) Added keyword comments for clarification.
3) Removed peak flux comment line per R.Walker.
4) Added observation-specific keywords at end of header.
5) Corrected original DATAMIN values.
Note: Image size is 1.0 degree by 0.5 degree.
Pixel size is 24 arcsec by 24 arcsec.
"
WAVELENGTH = 25 <MICRON>
MEAN_OBSERVATION_TIME= 1983-07-14T07:00:28.800
B1950_RIGHT_ASCENSION= 205.57306 <DEGREE>
B1950_DECLINATION= -11.23256 <DEGREE>
SOLAR_ELONGATION= 96.94150 <DEGREE>
OBSERVATION_INCLINATION = 359.40840 <DEGREE>
EXPOSURE_COUNT= 7
EXPOSURE_DURATION = 336 <SECOND>
SOLAR_DISTANCE = 1.492 <AU>
TARGET_CENTER_DISTANCE = 0.976 <AU>
PHASE_ANGLE = 42.566 <DEGREE>
^HEADER= "S339_25UM_01_RADIANCE.FIT"
^IMAGE= ("S339_25UM_01_RADIANCE.FIT", 3)
OBJECT = HEADER
BYTES = 5760
HEADER_TYPE = "FITS"
INTERCHANGE_FORMAT = "BINARY"
```

```

RECORDS= 2
DESCRIPTION = "FITS format defined in NASA/Science Office Standards Technology
100-1.0"
END_OBJECT = HEADER
OBJECT= IMAGE
LINE_SAMPLES= 150
LINES= 75
SAMPLE_BITS = 32
SAMPLE_TYPE = "IEEE_REAL"
AXIS_ORDER_TYPE = "FIRST_INDEX_FASTEST"
UNIT = "W.cm**-2.sr**-1"
MAXIMUM = 3.49116E-10
MINIMUM= 9.39122E-17
SAMPLING_PARAMETER_NAME= ("SOLAR_ELONGATION", "OBSERVATION_INCLINATION")
SAMPLING_PARAMETER_INTERVAL= (24, 24)
SAMPLING_PARAMETER_UNIT= (" ARCSECOND/PIXEL", "ARCSECOND/PIXEL")
SAMPLE_DISPLAY_DIRECTION= "RIGHT"
LINE_DISPLAY_DIRECTION= "UP"
END_OBJECT= IMAGE
NOTE = "
1) IPAC HIRES iteration number = 01.
2) Images were constructed by referencing the samples to the
the orbital position of the comet at the time of the sample.
Thus the comet is always at the central pixel (75, 37), by
virtue of its orbital elements. B1950_RIGHT_ASCENSION and
B1950_DECLINATION are the mean right ascension and declination
assigned to comet. The SOLAR_ELONGATION and
OBSERVATION_INCLINATION reference the pixel of maximum
brightness for the comet.
3) Orbital elements used in processing the scans:
Time of perihelion passage = 2445525.28637
Argument of perihelion = 179.0359495
Longitude of ascending node = 68.3281383
Inclination = 10.5552609
Eccentricity = .520840143
Perihelion distance = 1.491098651
4) North is approximately up and the Sun is to the right, based
on the values for SAMPLE_DISPLAY_DIRECTION and
SAMPLE_LINE_DIRECTION.
"
END

```

2.4.2 Example of Survey Photometry Data Header In PDS Format

```
PDS_VERSION_ID= PDS3
LABEL_REVISION_NOTE= "2003-04-29, Ray Espiritu (ACT), initial release."
RECORD_TYPE= FIXED_LENGTH
RECORD_BYTES= 25
FILE_RECORDS= 47
^TABLE= "S339_25UM_28_RADIANCE.TAB"
DATA_SET_ID= "IRAS-C-FPA-5-TEMPEL1-DI-V1.0"
PRODUCT_NAME= "IRAS Survey Tempel 1 Photometry Radiance 25micron"
PRODUCT_ID= "S339_25UM_28_RADIANCE_TAB_200304"
PRODUCT_CREATION_TIME= 2003-04-29T13:01:00.000
INSTRUMENT_HOST_NAME= "INFRARED ASTRONOMICAL SATELLITE"
INSTRUMENT_NAME= "FOCAL PLANE ARRAY"
TARGET_NAME= "9P/TEMPEL 1 (1867 G1)"
START_TIME= 1983-07-14T02:53:05.360
STOP_TIME= 1983-07-14T13:11:47.180
SPACECRAFT_CLOCK_START_COUNT= 79843985.36
SPACECRAFT_CLOCK_STOP_COUNT = 79881107.18
NOTE = "Images were constructed by referencing the radiance samples to the
orbital position of the comet at the time of the sample. Thus the comet is
always at pixel (75, 37), the center of the image, by virtue of its orbital
elements. Therefore, B1950_RIGHT_ASCENSION and B1950_DECLINATION refer to the
mean right ascension and declination assigned to comet. However, the maximum
radiance of the comet is not always located at the center of the image.
MAXIMUM_TARGET_RADIANCE_SAMPLE and MAXIMUM_TARGET_RADIANCE_LINE identify the
location of the pixel that contains the maximum radiance of the comet.
/ DATA/AO/IMAGE/S339_25UM_28_RADIANCE.FIT. "
WAVELENGTH = 25 <MICRON>
MEAN_OBSERVATION_TIME= 1983-07-14T07:00:28.800
B1950_RIGHT_ASCENSION= 205.57306 <DEGREE>
B1950_DECLINATION= -11.23256 <DEGREE>
SOLAR_ELONGATION = 96.94150 <DEGREE>
OBSERVATION-INCLINATION = 359.40840 <DEGREE>
EXPOSURE_COUNT = 7
EXPOSURE_DURATION = 336 <SECOND>
SOLAR_DISTANCE = 1.492 <AU>
TARGET_CENTER_DISTANCE = 0.976 <AU>
PHASE_ANGLE = 42.566 <DEGREE>
RECORD_FORMAT = "(i4,1x,e11.3,1x,i5)"
OBJECT= TABLE
  INTERCHANGE_FORMAT= "ASCII"
  ROWS = 28
  ROW_BYTES = 25
  COLUMNS = 3
  DESCRIPTION = "Photometry of the coma of comet Tempel 1, using an IRAS scan
survey image."
  OBJECT = COLUMN
  COLUMN_NUMBER = 1
  NAME= "APERATURE RADIUS"
  DESCRIPTION= "The radius of the photometric aperture. Zero is the central
pixel, the pixel of maximum radiance."
  DATA_TYPE = "ASCII_INTEGER"
  START_BYTE = 1
  BYTES = 4
  FORMAT = "I4"
  UNIT= "PIXEL"
END_OBJECT = COLUMN
OBJECT = COLUMN
  COLUMN_NUMBER = 2
  NAME= "RADIANCE"
```

```
DESCRIPTION = "The sum of the radiance from all pixels within the photometric
aperture."
DATA_TYPE = "ASCII_REAL"
START_BYTE = 6
BYTES = 12
FORMAT = "E12.4"
UNIT= "WATTS/CM**2"
END_OBJECT = COLUMN
OBJECT = COLUMN
COLUMN_NUMBER = 3
NAME= "TOTAL PIXELS"
DESCRIPTION = "The number of pixels summed to produce the radiance."
DATA_TYPE = "ASCII_INTEGER"
START_BYTE = 19
BYTES = 5
FORMAT = "I5"
UNIT= PIXEL
END_OBJECT = COLUMN
END_OBJECT= TABLE
END
```

2.4.3 Example of Additional Observation Image Data Header In PDS Format

```
PDS_VERSION_ID = "PDS3"
LABEL_REVISION_NOTE = "2003-04-25, Ray Espiritu (ACT), initial release."
FILE_RECORDS = 84
RECORD_TYPE = "FIXED_LENGTH"
RECORD_BYTES = 2880
DATA_SET_ID = "IRAS-C-FPA-5-RDR-DI-TEMPEL1-V1.0"
PRODUCT_ID = "S287_O13_100UM_1_NOISE_FIT_200304"
PRODUCT_CREATION_TIME = 2003-04-25T17:43:21
INSTRUMENT_HOST_NAME = "INFRARED ASTRONOMICAL SATELLITE"
INSTRUMENT_NAME = "IRAS FOCAL PLANE ARRAY"
TARGET_NAME = "9P/TEMPEL 1 (1867 G1)"
START_TIME = 1983-06-18T06:36:37.000
STOP_TIME = 1983-06-18T06:49:21.000
SPACECRAFT_CLOCK_START_COUNT = 77610997
SPACECRAFT_CLOCK_STOP_COUNT = 77611761
DESCRIPTION = " IRAS Additional Observation (Pointed) noise map produced by the
Infrared Processing and Analysis Center (IPAC) HIRES package. IPAC HIRES
documentation states that noise maps indicate the internal photometric error of
the detector samples resulting from the averaging of those that overlap, and is
essentially the standard deviation of contributions to each pixel. It does not
include absolute errors such as calibration errors. These maps can thus be used
to show the relative noise across an image, but not the absolute level of the
photometric noise. "
PROCESSING_HISTORY_TEXT = "
THIS IMAGE REPRESENTS THE PHOTOMETRIC NOISE FROM A YORIC RUN. THE CALCULATION
OF THIS NOISE IS DESCRIBED IN THE YORIC SDS.
    SOP =          287
    OBS =          13
    Describe method: Baseline removal
    Laundr version: 1.39 951004
    Raw data were Laundred on 11/22/ 0
    Pass 3 CRDD were used; Level 1 Archive usage: NONE
    Data are on the AC scale
    AOCRDD VERSION 4.2 940603; date of run: 11/22/00
    Jan 2003, PDS Small Bodies Node modified the header:
    1) Removed the unused NAXIS3 = 1 keyword.
    2) Corrected several keywords and values.
    3) Added keyword comments for clarification.
    4) Added observation-specific keywords at end of header.
    Note: Image size is 1 degree by 1 degree.
    Pixel size is 15 arcsec by 15 arcsec. "
WAVELENGTH= 100 <micro>
B1950_RIGHT_ASCENSION = 194.0374908 <DEGREE>
B1950_DECLINATION = -0.6277800202 <DEGREE>
MEAN_OBSERVATION_TIME = 1983-06-18T06:43:12.000
SOLAR_DISTANCE = 1.507 <AU>
TARGET_CENTER_DISTANCE = 0.853 <AU>
PHASE_ANGLE = 40.1 <DEGREE>
EXPOSURE_DURATION = 428 <SECOND>
^HEADER = "S287_O13_100UM_1_NOISE.FIT"
^IMAGE = ("S287_O13_100UM_1_NOISE.FIT", 4)
OBJECT = HEADER
BYTES = 8640
HEADER_TYPE = "FITS"
INTERCHANGE_FORMAT = "BINARY"
RECORDS= 3
```


DESCRIPTION = "FITS format defined in NASA/Science Office Standards Technology
100-1.0 "

END_OBJECT = HEADER

OBJECT = IMAGE

LINE_SAMPLES = 241

LINES = 241

SAMPLE_BITS = 32

SAMPLE_TYPE = "IEEE_REAL"

AXIS_ORDER_TYPE = "FIRST_INDEX_FASTEST"

UNIT = " W.cm**-2.sr**-1"

SAMPLING_PARAMETER_NAME = ("RA---CAR","DEC--CAR")

SAMPLING_PARAMETER_INTERVAL = (-0.004166666884, 0.004166666884)

SAMPLING_PARAMETER_UNIT = ("DEGREE/PIXEL","DEGREE/PIXEL")

SAMPLE_DISPLAY_DIRECTION = "RIGHT"

LINE_DISPLAY_DIRECTION = "UP"

MAXIMUM = 2.1979793E-14

MINIMUM = 1.6942433E-15

END_OBJECT = IMAGE

NOTE =

- 1) IPAC HIRES iteration number = 1.
- 2) EXPOSURE_DURATION is the actual time spent observing the target. The total duration of the observation is 764 seconds. It includes time used to make attitude updates at the beginning and end of the observation and is the difference in START_TIME and STOP_TIME.
- 3) B1950_RIGHT_ASCENSION and B1950_DECLINATION refer to the right ascension and declination assigned to the pixel at the center of the image.
- 4) North is up and East is to the left, based on SAMPLE_DISPLAY_DIRECTION and SAMPLE_LINE_DIRECTION.5) 'RA---CAR' and 'DEC--CAR' values for SAMPLING_PARAMETER_NAME indicate a Plate Carree projection for right ascension and declination. For more information see CALABRETTA&GREISEN02 and GREISEN&CALABRETTA02
- 6) NOT_APPLICABLE_CONSTANT of -9999.00 identifies an array element outside the scan area
- 7) The effective beam sizes, provided by HIRES processing are included below to illustrate how the effective spatial resolution varies over the map by providing the dimensions of a rectangular Gaussian profile of a resolution element at different locations in the image.

Effective Beam Sizes in the Beam Sample Image (Band 4, 20 Iterations)

(I,J) = IRAF pixel coordinates; Maj & Min = FWHM axes of Gaussian fit;
PosAng = position angle, East of North; Spike & Bckgrnd are model inputs;
number of pixels into which spike is smeared is on the order of Spike/Peak

Pixel (I,J)	RA	Dec	Maj	Min	PosAng	RA/DecErr	Peak	Spike	Bckgrnd
			\	\	deg	\	Jy/pix	Jy	Jy/pix
121 25	125609.0	-010140	128	82	118	-2 1	0.205	10.00	0.001
169 25	125521.0	-010140	129	84	115	1 3	0.199	10.00	0.002
217 25	125433.0	-010140	162	79	120	4 -3	0.125	10.00	0.000
73 73	125657.0	004940	82	71	11	-13 7	0.022	10.00	0.000
121 73	125609.0	004940	149	97	120	-3 4	0.144	10.00	0.000
169 73	125521.0	004940	130	86	119	-2 1	0.177	10.00	0.001
73 121	125657.0	003740	162	81	118	-3 0	0.115	10.00	0.000
121 121	125609.0	003740	132	86	118	0 -1	0.167	10.00	0.000
169 121	125521.0	003740	168	87	118	-4 2	0.116	10.00	0.000
73 169	125657.0	002540	129	86	119	2 0	0.177	10.00	0.002
121 169	125609.0	002540	133	86	119	-4 2	0.196	10.00	0.000
169 169	125521.0	002540	89	71	167	-7 10	0.051	10.00	0.000
25 217	125745.0	001340	158	82	118	15 -10	0.119	10.00	0.000
73 217	125657.0	001340	153	86	124	-17 6	0.153	10.00	0.001

121 217 125609.0 001340 145 89 118 2 -2 0.162 10.00 0.001
"
END

2.4.4 Example of Additional Observation Photometry Data Header In PDS Format

```
PDS_VERSION_ID = PDS3
LABEL_REVISION_NOTE = "2003-04-29, Ray Espiritu (ACT), initial release."
RECORD_TYPE= FIXED_LENGTH
RECORD_BYTES = 24
FILE_RECORDS = 47
^TABLE= "S287_013_100UM_1_RADIANCE.TAB"
DATA_SET_ID= "IRAS-C-FPA-5-RDR-DI-TEMPEL1-V1.0"
PRODUCT_NAME = "IRAS Pointed Tempell Photometry 100micron"
PRODUCT_ID= "S287_013_100UM_1_RADIANCE_TAB_200304"
PRODUCT_CREATION_TIME= 2003-04-29T14:43:50.000
INSTRUMENT_HOST_NAME= "INFRARED ASTRONOMICAL SATELLITE"
INSTRUMENT_NAME= "FOCAL PLANE ARRAY"
TARGET_NAME= "9P/TEMPEL 1 (1867 G1)"
START_TIME= 1983-06-18T06:36:37.000
STOP_TIME = 1983-06-18T06:49:21.000
SPACECRAFT_CLOCK_START_COUNT= 77610997
SPACECRAFT_CLOCK_STOP_COUNT = 77611761
RECORD_FORMAT= "(i4,1x,e11.3,1x,i5)"
NOTE = "B1950_RIGHT_ASCENSION and B1950_DECLINATION refer to the right
ascension and declination is assigned to the pixel at the center
of the image (121,121). MAXIMUM_TARGET_RADIANCE_SAMPLE and
MAXIMUM_TARGET_RADIANCE_LINE identify the location of the image
pixel that contains the maximum radiance of the comet.
The referenced AO image is
/ DATA/AO/IMAGE/S287_013_100UM_1_RADIANCE.FIT. "
WAVELENGTH= 100 <MICRON>
B1950_RIGHT_ASCENSION= 194.0374908 <DEGREE>
B1950_DECLINATION = -0.6277800202 <DEGREE>
MEAN_OBSERVATION_TIME= 1983-06-18T06:43:12.000
SOLAR_DISTANCE = 1.507 <AU>
TARGET_CENTER_DISTANCE = 0.853 <AU>
PHASE_ANGLE= 40.1 <DEGREE>
EXPOSURE_DURATION = 428 <SECOND>
OBJECT= TABLE
INTERCHANGE_FORMAT = "ASCII"
ROWS= 47
ROW_BYTES= 24
COLUMNS= 3
DESCRIPTION = "Photometry of the coma of comet 9P/Tempel 1,
using an IRAS pointed (additional observation) image."
OBJECT = COLUMN
COLUMN_NUMBER= 1
NAME= "APERATURE RADIUS"
DESCRIPTION= "The radius of the photometric aperture.
Zero is the central pixel, the pixel of maximum radiance."
DATA_TYPE= "ASCII_INTEGER"
START_BYTE = 1
BYTES = 4
FORMAT= "I4"
UNIT= "PIXEL"
END_OBJECT= COLUMN
OBJECT = COLUMN
COLUMN_NUMBER= 2
NAME= "RADIANCE"
DESCRIPTION= "The sum of the radiance from all pixels within the photometric
aperture."
DATA_TYPE= "ASCII_REAL"
```

```
START_BYTE = 6
BYTES = 11
FORMAT= "E11.3"
UNIT= "WATTS/CM**2"
END_OBJECT= COLUMN
OBJECT = COLUMN
COLUMN_NUMBER= 3
NAME= "TOTAL PIXELS"
DESCRIPTION= "The number of pixels summed to produce the radiance."
DATA_TYPE= "ASCII_INTEGER"
START_BYTE = 18
BYTES = 5
FORMAT= "I5"
UNIT= "PIXEL"
END_OBJECT= COLUMN
END_OBJECT= TABLE
END
```

2.5 IRAS PDS Keyword Definitions :

The keywords are listed approximately in the order in which they appear in the example labels shown above in section 2.4. Note that the Survey and AO PDS labels each have a slightly different layout, hence the approximate location in the following list.

PDS_VERSION_ID

The PDS_VERSION_ID data element represents the version number of the PDS standards documents that is valid when a data product label is created. PDS3 is used for the IRAS Data products.

LABEL_REVISION_NOTE

The LABEL_REVISION_NOTE element is a free-form unlimited length character string providing information regarding the revision status and authorship of a PDS label. This should include the latest revision date and author of the current version, but may include a more complete history. This element is required in all Catalog labels and should be the second element in the label.

FILE_RECORDS

The FILE_RECORDS element indicates the number of physical file records, including both label records and data records.

Note: In the PDS the use of file records along with other file-related data elements is fully described in the Standards Reference.

RECORD_TYPE

The RECORD_TYPE element indicates the record format of a file. The value FIXED_LENGTH is used in the IRAS data products. The physical record length (RECORD_BYTES) corresponds directly to the logical record length of the data objects (that is, one physical record for each image line, or one physical record for each row of a table).

RECORD_BYTES

The RECORD_BYTES element indicates the number of bytes in a physical file record, including record terminators and separators.

^TABLE

The TABLE object is a uniform collection of rows containing ASCII and/or binary values stored in columns.

Note: In the PDS, if any of the columns in a table are in binary format, the value of the keyword interchange_format is BINARY and the value of record_type is FIXED_LENGTH. On the other hand, if the columns contain only ASCII data, interchange_format = ASCII and record_type can equal STREAM, VARIABLE_LENGTH, or FIXED_LENGTH.

DATA_SET_ID

The DATA_SET_ID element is a unique alphanumeric identifier for a data set or a data product. The DATA_SET_ID value for a given data set or product is constructed according to flight project naming conventions. In most cases the DATA_SET_ID is an abbreviation of the DATA_SET_NAME.

Example value: IRAS-C-FPA-5-AOPHOT-TEMPEL1-DI-V1.0

Note: In the PDS, the values for both DATA_SET_ID and DATA_SET_NAME are constructed according to standards outlined in the Standards Reference.

PRODUCT_NAME

The PRODUCT_NAME element provides the full name of a product. It is related to PRODUCT_ID and provides a brief, descriptive title for a particular data product (i.e. a single file).

PRODUCT_ID

The PRODUCT_ID data element represents a permanent, unique identifier assigned to a data product by its producer.

Note: In the PDS, the value assigned to PRODUCT_ID must be unique within its data set. Additional note: The PRODUCT_ID can describe the lowest-level data object that has a PDS label.

PRODUCT_CREATION_TIME

The PRODUCT_CREATION_TIME element defines the UTC system format time when a product was created. Formation rule: YYYY-MM-DDThh:mm:ss[.fff]

INSTRUMENT_HOST_NAME

The INSTRUMENT_HOST_NAME element provides the full name of the host on which an instrument is based. This host can be either a spacecraft or an earth base. Thus, the INSTRUMENT_HOST_NAME element can contain values which are either SPACECRAFT_NAME values or EARTH_BASE_NAME values.

INSTRUMENT_NAME

The INSTRUMENT_NAME element provides the full name of an instrument.

Note: that the associated INSTRUMENT_ID element provides an abbreviated name or acronym for the instrument.

TARGET_NAME

The TARGET_NAME element identifies a target. The target may be a planet, satellite, ring, region, feature, asteroid or comet. See TARGET_TYPE.

START_TIME

The START_TIME element provides the date and time of the beginning of an event or observation (whether it be a spacecraft, ground-based, or system event) in UTC system format. Formation rule: YYYY-MM-DDThh:mm:ss[.fff]

STOP_TIME

The STOP_TIME element provides the date and time of the end of an observation or event (whether it be a spacecraft, ground-based, or system event) in UTC system format. Formation rule: YYYY-MM-DDThh:mm:ss[.fff]

SPACECRAFT_CLOCK_START_COUNT

The SPACECRAFT_CLOCK_START_COUNT element provides the value of the spacecraft clock at the beginning of a time period of interest.

SPACECRAFT_CLOCK_STOP_COUNT

The SPACECRAFT_CLOCK_STOP_COUNT element provides the value of the spacecraft clock at the end of a time period of interest.

DESCRIPTION:

The DESCRIPTION element provides a free-form, unlimited-length character string that represents or gives an account of something.

PROCESSING_HISTORY_TEXT

The PROCESSING_HISTORY_TEXT element provides an entry for each processing step and program used in generating a particular data file.

WAVELENGTH

The WAVELENGTH element identifies the mean wavelength to which an instrument detector/filter combination is sensitive.

B1950_RIGHT_ASCENSION

The B1950_RIGHT_ASCENSION element provides the right ascension of a star or other object using the B1950 coordinate frame rather than the J2000 frame.

B1950_DECLINATION

The B1950_declination element provides the declination of a star or other object using the B1950 coordinate frame rather than the J2000 frame.

MEAN_OBSERVATION_TIME

The MEAN_OBSERVATION_TIME is the average date and time associated with an observation that itself consists of recording multiple events (photon arrival times, for example). It is distinct from OBSERVATION_TIME, which is the midpoint of the observation period, in that it is calculated by taking the arithmetic average of all event times associated with the single observation. For IRAS Additional Observation (AO) images, this is the observing time spent on the target. The rest of the time was used to make fine attitude updates on reference stars at the beginning and at the end of an AO. See also EXPOSURE_DURATION.

SOLAR_ELONGATION

The angle between the line of sight of observation and the direction of the Sun. For IRAS the line of sight of observation is the boresight of the telescope as measured by the satellite sun sensor.

OBSERVATION_INCLINATION

The inclination of an observation with respect to a non-standard coordinate system. The IRAS satellite has a natural, non-standard, coordinate system defined by SOLAR_ELONGATION and OBSERVATION_INCLINATION. OBSERVATION_INCLINATION is the angle between the ecliptic plane and the plane containing the Earth, Sun, and the observation direction (that is, the azimuth angle about the Earth-Sun axis). The value is zero when IRAS looks at the ecliptic plane in the direction opposite to the motion of the Earth around the Sun. The value increases clockwise around the Earth-Sun axis when facing the Sun, and opposite from the direction of the motion of the satellite in its polar orbit about the Earth. OBSERVATION_INCLINATION is related to IRAS_CLOCK_ANGLE by the relation:

$$\text{observation_inclination} = 90 - \text{iras_clock_angle}.$$

SOLAR_ELONGATION and OBSERVATION_INCLINATION are related to geocentric ecliptic latitude (beta) and longitude (lamda) and the longitude of the Sun (lamda Sun) through the relations:

$$\begin{aligned}\sin(\text{observation_inclination}) &= \sin(\text{beta})/\sin(\text{solar_elongation}) \\ \cos(\text{solar_elongation}) &= \cos(\text{beta}) * \cos(\text{lamda} - \text{lamda Sun}).\end{aligned}$$

PDS defines IRAS_CLOCK_ANGLE as the satellite viewing angle projected onto the plane perpendicular to the Sun- line, measured from ecliptic North, clockwise as viewed from the Sun. This is the same direction as the IRAS orbital motion.

EXPOSURE_COUNT

The EXPOSURE_COUNT element provides the maximum number of exposures taken during a specified interval. The value is dependent on exposure type.

EXPOSURE_DURATION

The EXPOSURE_DURATION element provides the value of the total time spent observing the target.

SOLAR_DISTANCE

The SOLAR_DISTANCE element provides the distance from the center of the sun to the center of a target body.

TARGET_CENTER_DISTANCE

The TARGET_CENTER_DISTANCE element provides the distance between an instrument and the center of mass of the named target.

PHASE_ANGLE

The PHASE_ANGLE element provides a measure of the relationship between the instrument viewing position and incident illumination (such as solar light). PHASE_ANGLE is measured at the target; it is the angle between a vector to the illumination source and a vector to the instrument. If not specified, the target is assumed to be at the center of the instrument field of view. If illumination is from behind the instrument, the PHASE_ANGLE will be small.

RECORD_FORMAT

The RECORD_FORMAT element contains a FORTRAN-style format description for reading an entire row of an ASCII/EBCDIC table, or an entire occurrence of an ASCII/EBCDIC COLLECTION

^HEADER

The HEADER object is used to identify and define the attributes of commonly used header data structures for non-PDS formats such as VICAR or FITS. These structures are usually system or software specific and are described in detail in a referenced description text file. The use of bytes within the header object refers to the number of bytes for the entire header, not a single record.

^IMAGE

An IMAGE object is a regular array of sample values. Image objects are normally processed with special display tools to produce a visual representation of the sample values. This is done by assigning brightness levels or display colors to the various sample values. Images are composed of LINES and SAMPLES. They may contain multiple bands, in one of several storage orders.

Note: Additional engineering values may be prepended or appended to each LINE of an image, and are stored as concatenated TABLE objects, which must be named LINE_PREFIX and LINE_SUFFIX. IMAGE objects may be associated with other objects, including HISTOGRAMs, PALETTEs, HISTORY, and TABLEs which contain statistics, display parameters, engineering values, or other ancillary data.

ROWS

The ROWS element represents the number of rows in a data object.

ROW_BYTES

The ROW_BYTES element represents the maximum number of bytes in each data object row.

COLUMNS

The COLUMNS element represents the number of columns in each row of a data object.

BYTES

The BYTES element indicates the number of bytes allocated for a particular data representation.

HEADER_TYPE

The HEADER_TYPE element identifies a specific type of header data structure. For example: FITS, VICAR.

Note: In the PDS, HEADER_TYPE is used to indicate non-PDS headers.

INTERCHANGE_FORMAT

The INTERCHANGE_FORMAT element represents the manner in which data items are stored.

Example values: BINARY, ASCII.

RECORDS

The RECORDS data element identifies the number of physical records in a file or other data object.

DESCRIPTION

The DESCRIPTION element provides a free-form, unlimited-length character string that represents or gives an account of something.

START_BYTE

The START_BYTE element in a data object identifies the location of the first byte of the object, counting from 1. For nested objects, the START_BYTE value is relative to the start of the enclosing object.

COLUMN_NUMBER

The COLUMN_NUMBER element identifies the location of a specific column within a larger data object, such as a table. For tables consisting of rows ($i = 1, N$) and columns ($j = 1, M$), the column number is the j -th index of any row.

NAME

The NAME data element indicates a literal value representing the common term used to identify an element or object

FORMAT

A specified or predetermined arrangement of data within a file or on a storage medium

LINE_SAMPLES

The LINE_SAMPLES element indicates the total number of data instances along the horizontal axis of an image.

LINES

The LINES element indicates the total number of data instances along the vertical axis of an image.

SAMPLE_BITS

The SAMPLE_BITS element indicates the stored number of bits, or units of binary information, contained in a line sample value.

SAMPLE_TYPE

The SAMPLE_TYPE element indicates the data storage representation of sample value.

AXIS_ORDER_TYPE

The AXIS_ORDER_TYPE element is used to identify the storage order for elements of a multidimensional ARRAY object. The default storage order for an ARRAY object presumes the rightmost or last index of a sequence varies the fastest. This is the ordering used in the C programming language and is equivalent to ROW_MAJOR storage order for COLUMN elements within tables. Specifying an AXIS_ORDER_TYPE of FIRST_INDEX_FASTEST may be used for ARRAYs that must be labeled and referenced in the reverse, and is the ordering used in the Fortran programming language.

UNIT

The UNIT element provides the full name or standard abbreviation of a unit of measurement in which a value is expressed. Example values: square meter, meter per second.

Note: A table of standard units representing those published by the Systeme Internationale appears in the 'Units of Measurement' section of the PSDD. (Please refer to the table of contents for its location.) The values in this table's 'Unit Name' column constitute the standard values for the data element UNIT.

MAXIMUM

The MAXIMUM data element represents the maximum value that is valid for a data object. MINIMUM and MAXIMUM define the valid range of values for a data object, such as -90 to 90 for a column object containing latitude values.

MINIMUM

The MINIMUM data element represents the minimum value that is valid for a data object. MINIMUM and MAXIMUM define the valid range of values for a data object, such as -90 to 90 for a column object containing latitude values. Note: this element should appear in labels only between the 'OBJECT =' and 'END_OBJECT=' lines of an object with a specific data type.

SAMPLING_PARAMETER_NAME

The SAMPLING_PARAMETER_NAME element provides the name of the parameter which determines the sampling interval of a particular instrument or

dataset parameter. For example, magnetic field intensity is sampled in time increments, and a spectrum is sampled in wavelength or frequency.

SAMPLING_PARAMETER_INTERVAL

The SAMPLING_PARAMETER_INTERVAL element identifies the spacing of points at which data are sampled and at which a value for an instrument or dataset parameter is available. This sampling interval can be either the original (raw) sampling or the result of some resampling process. For example, in 48-second magnetometer data the sampling interval is 48. The sampling parameter (time, in the example) is identified by the SAMPLING_PARAMETER_NAME element.

SAMPLING_PARAMETER_UNIT

The SAMPLING_PARAMETER_UNIT element specifies the unit of measure of associated data sampling parameters.

SAMPLE_DISPLAY_DIRECTION

The SAMPLE_DISPLAY_DIRECTION element is the preferred orientation of samples within a line for viewing on a display device. The default is right, meaning samples are viewed from left to right on the display. See also LINE_DISPLAY_DIRECTION.

LINE_DISPLAY_DIRECTION

The LINE_DISPLAY_DIRECTION element is the preferred orientation of lines within an image for viewing on a display device. The default value is down, meaning lines are viewed top to bottom on the display.

NOTE

The NOTE element is a text field, which provides miscellaneous notes or comments (for example, concerning a given data set or a given data processing program).

3 APPENDICES

Appendix - Data Archive Terms

Definition of Terms:

Archive	An archive consists of one or more data sets along with all the documentation and ancillary information needed to understand and use the data. An archive is a logical construct independent of the medium on which it is stored.
Archive volume, archive volume set	A volume is a unit of medium on which data products are stored; for example, one DVD. An archive volume is a volume containing all or part of an archive; that is, data products plus documentation and ancillary files. When an archive spans multiple volumes, they are called an archive volume set. Usually the documentation and some ancillary files are repeated on each volume of the set, so that a single volume can be used alone.
Data Product	A labeled grouping of data resulting from a scientific observation, usually stored in one file. A product label identifies, describes, and defines the structure of the data. An example of a data product is a planetary image, a spectrum table, or a time series table.
Data Set	An accumulation of data products. A Data set together with supporting documentation and ancillary files is an archive.
Experiment Data Records	Nasa Level 0 data for a given instrument; raw data. Same as CODMAC level2.
Reduced data records	Science data that have been processed from raw data to NASA Level 1 or higher. See Table for definitions of processing levels.
Standard data product	A data product that have been defined during the proposal and selection process and that is contractually promised by the PI as part of the investigation. Standard data products are generated in a predefined way, using well-understood procedures, and processed in “pipeline” fashion.

Appendix - CODMAC and NASA Data Levels

CODMAC/NASA Definition of processing levels for science data sets

CODMAC Level	Proc. Type	Data Processing Level Description
1	Raw Data	Telemetry data with data embedded.
2	Edited Data	Corrected for telemetry errors and split or decommutated into a data set for a given instrument. Sometimes called Experimental Data Record(EDR).Data are also tagged with time and location of acquisition. Corresponds to NASA Level 0 data.
3	Calibrated Data	Edited data that are still in units produced by instrument, but have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No resampling, so edited data can be reconstructed. Corresponds to NASA Level 1A.
4	Resampled data	Data that have been resampled in the time or space domains in a such way that the original edited data cannot be reconstructed. Could be calibrated in addition to being resampled . Corresponds to NASA Level 1B.
5	Derived Data	Derived results, as maps, reports, graphics, etc. Corresponds to NASA Levels 2 through 5
6	Ancillary Data	Non-Science data needed to generate calibrated or resampled data sets. Consists of instrument gains, offsets; pointing information for scan platforms, etc.
7	Corrective Data	Other science data needed to interpret space-borne data sets. May include ground based data observations such as soil type or ocean buoy measurements of wind drift.
8	User Description	Description of why the data were required, any peculiarities associated with the data sets., and enough documentation to allow secondary user to extract information from the data.
n	n	Not Applicable

The above is based on the national research council committee on data management and computation (CODMAC) data levels.

Appendix - Acronyms

ACRONYMS

ACT	Applied Coherent Technology Corporation
AIAA	American Institute of Aeronautics and Astronautics
AO	Additional Observations
ASCII	American Standard Code for Information Interchange
ATDF	Archival Tracking Data File
B-frame	Body Frame
CIP	Comet Image Processor
CCSDS	Consultative Committee for Space Data Systems
CDF	Common Data Format
CFDP	CCSDS File Delivery Protocol
CoDMAC	Committee on Data Management and Computation
COP	Command Operation Procedure
EDR	Experimental Data Records
EK	Event Kernel
FITS	Flexible Image Transport System
FOP	Frame Operation Procedure
FOV	Field-of-View
FPA	Focal Plane Assembly
FTP	File Transfer protocol
GSFC	Goddard Space Flight Center
I&T	Integration and Test
IRAS	Infrared Astronomical Satellite
IMU	Inertial Measurement unit
MET	Mission Elapsed Time
MCM	Maximum Correlation Method
NAIF	Navigation and Ancillary Information Facility
NASA	Navigation Aeronautics and Space Administration
NSSDC	National Space Science Data Center
ODF	Orbit Data File
ODL	Object Description Language
OBS	Observation
OWLT	One-Way Light Time
PDS	Planetary Data System
RDR	Reduced data Record
SBN	Small Body Node
SFDU	Standard Formatted Data Unit
SIS	Software Interface Specification
SOP	Satellite Operations Plan